



## THE SPANISH SYSTEM FOR THE RADIOLOGICAL SURVEILLANCE AND CONTROL OF SCRAP AND THE PRODUCTS RESULTING FROM ITS PROCESSING

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**Abstract.** Despite the fact that the use of radiation technologies has always been subjected to strict controls in most countries, the presence of radioactive materials in scrap has been detected relatively often in recent years. This has led to the implementation of a series of international initiatives aimed at detecting and preventing illicit international trafficking with radioactive material, intentional or otherwise.

The Spanish iron and steel industry is one of the most important industrial sectors in the country, and depends to a large extent on the importing of a significant proportion of the scrap its uses as raw material. Experience has shown that that countries that import large quantities of scrap should complement the aforementioned international initiatives with others of national scope, in order to reduce the risks arising from the presence of radioactive material in scrap.

In this context, the Spanish radiological protection authorities, along with the business associations involved in the metal recovery and smelting industry, have established a national system for the radiological surveillance and control of scrap and of the products resulting from its processing.

The system consists of a set of legal bases, the installation of specific radiological surveillance equipment and the enhancement of other general purpose equipment that existed prior to these initiatives, the development of radiological training and information plans for the professionals involved in the metal recovery and smelting sectors and improvement to the national radiological emergency response system.

### BACKGROUND

Until the incident that occurred at the ACERINOX factory in May 1998, the presence of radioactive material in scrap had been considered a potential risk in Spain. The event underlined the fact that it was very much a real risk, which might have important health, environmental and, especially, economic consequences.

Prior to the ACERINOX incident, there was general concern regarding this risk. This had not, however, led to any system for systematic action, although certain steelyards had installed detection systems at their entrances and the Nuclear Safety Council (CSN) had initiated a campaign aimed at informing workers in the metal recovery and smelting industries of the risks arising from the presence of radioactive material in scrap.

The event that occurred at ACERINOX was the direct reason for the Ministry of Industry and Energy (MINER) and the CSN to implement two courses of action oriented towards:

- the recovery of affected installations
- the development of measures to avoid other similar events in the future.

The first of these was implemented with direct intervention by the companies owning the affected installations — ACERINOX, EGMASA and PRESUR — and the second with the collaboration of the Spanish Recovery Federation (FER), the Union of Iron and Steel Companies (UNESID) and the National Radioactive Waste Management Agency, Empresa Nacional de Residuos Radiactivos, S.A. (ENRESA).

## RECOVERY OF THE AFFECTED INSTALLATIONS

On 30 May 1998 a source of Cs-137 was accidentally smelled in one of the furnaces at the plant owned by ACERINOX in Los Barrios (Cádiz). This source had arrived at the steelyard incorporated in a maritime consignment of scrap that had probably come from the United States.

As a result of smelting of the source, both the ACERINOX plant itself and the industrial organic waste inerting plant belonging to EGMASA, located in Palos de la Frontera (Huelva), which manages fume dust from the steelyard, and the PRESUR experimental metallurgy plant in Fregenal de la Sierra (Badajoz), which uses steelyard dust for its processes, were contaminated. Also contaminated were the Inert Materials Recovery Centre (CRI-9) in Marisma de Mendaña (Huelva), where the inerted materials from EGMASA are tipped and, to a much lesser extent, the garage where some of the trucks that transported the contaminated material are washed.

ACERINOX informed the CSN of the contamination at the steelyard, and the Council immediately ordered that the installation be inspected. The results of the inspection were used for a preliminary assessment of the situation. It was concluded that there was an urgent need to perform a radiological characterization of the affected facilities, the surroundings and those geographical areas which, according to the meteorological information available, might have been affected by the possible release of Cs-137 to the atmosphere via the plant stack. Collaborating with the CSN in the performance of these actions were the Centre for Energy-Related, Environmental and Technological Research (CIEMAT), ENRESA and the PROINSA Radiological Protection Technical Unit (UTPR<sup>1</sup>), which provides support for the CSN in emergency situations.

In view of the results of the radiological characterization, the CSN concluded that the contamination was limited to the affected installations, and recommended that the owners carry out a survey of the internal contamination of the workers and that the MINER urgently adopt adequate radiological protection measures to resolve the radiological situation existing at the affected facilities.

The owner companies of the installations performed an internal dose measurement campaign on the workers, with technical support from the UNESA Mobile Internal Dosimetry Unit.

The Directorate General for Energy (DGE) of the MINER required each of the three companies owning the affected installations to draw up an action plan for decontamination of the facilities and management of the radioactive wastes generated.

ACERINOX, EGMASA and PRESUR prepared their respective action plans, which contained the following:

- a detailed radiological characterization plan.
- a plan for cleaning and decontaminating the affected facilities.
- a radiological protection plan for the cleaning and decontamination operations.

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<sup>1</sup> Organizations legally recognized for the rendering of the radiological protection services required by the regulations governing protection against ionising radiations at facilities not having their own radiological protection services.

The action plans were evaluated by the CSN, which established the radiological protection requirements to be met during the operations. The following are particularly important among these requirements:

- The individual doses occurring during the recovery operations were to be lower than 1 millisievert<sup>2</sup>.
- The operations were to be supervised by an UTPR.
- The radioactive wastes were to be managed by ENRESA, in accordance with a specific management plan.
- The results of the operations would be inspected by the CSN prior to this organization's issuing a favourable report, required for performance of the action plans to be declared completed.

ACERINOX, EGMASA and PRESUR carried out the operations foreseen in the action plans, adhering to the conditions established by the CSN, and the latter performed various inspections to check for compliance with these plans<sup>3</sup>.

ENRESA drew up a management plan for the radioactive wastes generated during the cleaning and decontamination operations, which was accepted by the CSN. In accordance with this plan, the radioactive wastes generated were removed from the installations for management at the El Cabril radioactive waste disposal facility. The criterion adopted for distinction between conventional and radioactive wastes was the criterion for the exemption of practices contained in Directive 96/29/EURATOM<sup>4</sup>.

The CSN continuously informed the local, regional, national and European Community authorities of the progress of the work, and issued various reports on the event and the cleaning and decontamination operations performed. These reports included data on the radiological characterisation of the installations, workers' dosimetry, environmental radiological surveillance, the waste generated and the facility recovery operations.

## **PREVENTIVE MEASURES**

For the development of preventive measures, the MINER and the CSN, with the collaboration of ENRESA, FER and UNESID, have implemented national system aimed at reducing the risks posed by the presence of radioactive material in scrap. The system is structured around:

- regulation of the radiological surveillance and control of scrap;
- installation and improvement of radiological surveillance systems;
- implementation of radiological training and information programmes; and
- enhancement of radiological emergency response plans.

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<sup>2</sup> For informative purposes, it should be pointed out that the annual dose limit for members of the public established by Directive 96/29/EURATOM is 1 millisievert/year.

<sup>3</sup> As of 31 March 2000, all the actions had been completed at the PRESUR and EGMASA plants and the final interventions were being performed at ACERINOX and CRI-9.

<sup>4</sup> The individual doses produced by the management of wastes considered to be non-radioactive are required to be less than 10 microsievert/year.

## **REGULATION OF THE RADIOLOGICAL SURVEILLANCE AND CONTROL OF SCRAP**

As soon as news of the ACERINOX incident became known, the Popular, Socialist and Izquierda Unida parliamentary groups of the Spanish Congress urged the Government to develop specific regulations for the radiological control of scrap. In response to these parliamentary initiatives, a study began of the national and international situation and of the practices adopted in other countries, leading to the actions described below.

### **INTERNATIONAL PRACTICE REGARDING THE RADIOLOGICAL SURVEILLANCE AND CONTROL OF SCRAP**

#### *ANALYSIS OF THE INTERNATIONAL SITUATION AND OF PRACTICES ADOPTED IN OTHER COUNTRIES*

No international organization responsible for radiological matters, and more specifically neither the International Atomic Energy Agency (IAEA), the European Commission (EC) nor the OECD Nuclear Energy Agency (NEA/OECD), had established standards or directives applicable to the radiological surveillance and control of scrap.

The EC, through the EURATOM Treaty Article 31 Group of Experts, had issued recommendations regarding levels of declassification for the recycling of scrap from nuclear installations. The IAEA had issued provisional recommendations on levels of declassification for solid materials containing low concentrations of radioactivity and, in collaboration with other international organisations, had published a safety guide on the prevention of illicit international trafficking in radioactive materials.

Systems for the radiological surveillance of scrap had been installed at steelyards, at certain recovery centres and at the borders of most OECD countries. In nearly all cases such installations had been voluntary and based on recommendations issued by the industry itself or by national or regional organizations responsible for radiological protection.

In summary it may be said that, with the exception of Italy, there is no systematic practice in place regulating the radiological surveillance of scrap at an international or national level.

#### *ACTIONS TAKEN*

In view of this situation, the Spanish Government, through letters from the Secretary of State for Energy to the Commissioners for Industry and the Environment, requested that the EC adopt Community-wide measures to preclude the radiological risks arising from the recycling of scrap.

In 1999, the EC called three meetings of experts from European Union countries in response to these letters, including the active participation of technicians from the MINER and from the CSN. At these meetings, Spain's actions regarding the legal development of the radiological surveillance of scrap were seen to be among the most advanced in Europe. The EC has announced the setting up of a Group of Experts to study the possibility of developing specific standards and establishing controls at ports and frontiers with non-member nations.

## DEVELOPMENT OF NATIONAL STANDARDS

### *ANALYSIS OF THE NATIONAL SITUATION*

At the time of the ACERINOX incident, the Spanish standards did not specifically contemplate the risks deriving from the presence of radioactive material in scrap, and did not require the radiological surveillance of such material. Likewise, no specific functions had been assigned to any body of the administration for control in this area.

### *ESTABLISHMENT OF THE LEGAL FRAMEWORK*

The Law governing Tariffs and Public Prices for the Services Rendered by the Nuclear Safety Council, Law 14/1999, of 5th May, has modified the Organisation's areas of competence, assigning to it the following functions:

- *“inspect, assess, control, report and propose to the competent authority the adoption of whatever prevention and correction measures might be required in the event of exceptional emergency situations .... when such situations arise in installations, equipment, companies or activities not subject to the system of authorisations included in the nuclear legislation”*
- *“control and watch over the radiological quality of the environment throughout the national territory... and collaborate with the competent authorities in relation to environmental radiological surveillance outside the areas of influence of nuclear or radioactive installations”*

Likewise, Law 14/1999 established that management of radioactive waste generated in such exceptional cases might be undertaken with expenses applied to the financial yield of the fund set up for management of the radioactive waste pertaining to the back-end of the nuclear fuel cycle (ENRESA Fund), in those cases in which the MINER were so to determine.

### *THE PROTOCOL FOR THE RADIOLOGICAL SURVEILLANCE OF SCRAP*

With a view to enacting the provisions of Law 14/1999, the MINER and the CSN have begun drawing up a specific regulation governing the radiological surveillance and control of scrap and the management of radioactive materials detected therein. As an intermediate step in this process, a collaboration protocol has been subscribed by the Administration and the companies involved in the metal recovery and smelting industries. The regulation to be implemented in the future will be the result of the experience acquired in applying this Protocol and of the evolution of the international standards applicable to this issue, especially at European Community level.

The protocol is a voluntary commitment subscribed by the Ministry of Industry and Energy, the Ministry of Public Works, the Nuclear Safety Council, the radioactive waste management agency, Empresa Nacional de Residuos Radiactivos, S.A., the Spanish Federation of Recovery Industries and the Association of Iron and Steel Companies, and is aimed at establishing a national system for the prevention of risks arising from the presence of radioactive material in scrap and in the products resulting from its processing. Subsequent to signing the protocol, the most representative trade unions in the metal industry decided to ratify its terms.

For implementation of the Protocol, the MINER created a register including all those scrap processing installations that had voluntarily accepted its terms. Following the entry of a

facility on this register, the MINER formally notifies both the company registered and the CSN.

The commitments acquired by each of the parties signing the protocol are as follows:

The MINER undertakes to:

- generically authorize the transfer to ENRESA of radioactive material detected in order to facilitate to the maximum extent the actions necessary for its removal;
- create and maintain a register of companies subscribing to the protocol; and
- direct whatever actions are required in the event of a situation of generalized contamination or the dispersion of radioactive material.

The Ministry of Public Works undertakes to:

- demand a certificate explicitly stating that merchandise has been subjected to radiological controls at the place of origin, prior to authorizing unloading at any Spanish port; and
- report to the CSN on any incident relating to the above.

The Nuclear Safety Council undertakes to:

- issue the recommendations and technical instructions required for implementation of the protocol;
- establish the radiological criteria to be used as a basis for the investigation and exemption levels necessary for implementation of the Protocol;
- inspect the radiological surveillance and control systems of the facilities;
- advise the different parties on issues relating to the radiological protection of people and the environment; and
- promote and co-ordinate training and information plans on instrumentation and radiological protection for the personnel of companies involved in the metal recovery and smelting industries.

ENRESA undertakes to:

- remove and store the radioactive materials detected in scrap and in the products resulting from its processing, when they exceed the exemption levels;
- provide technical advice to the companies subscribing to the Protocol, especially with regard to the return of radioactive materials to the supplier when such materials come from overseas;
- collaborate in the training and information plans; and
- establish a contract with the subscribing companies for the management of radioactive material detected.

The subscribing companies undertake to:

- establish a radiological surveillance and control system for each facility at which scrap is processed, deploying the technical, human (in-house or UTPR), organizational, training and logistical resources required to detect, isolate and analyse whatever radioactive material might be contained in scrap;

- require a certificate from overseas suppliers demonstrating that the merchandise supplied has been subjected to a radiological surveillance system;
- adopt the measures required to prevent the dispersion of radioactive material and isolate it under safe conditions pending removal by ENRESA;
- notify the CSN of the detection of radioactive materials in quantities or concentrations in excess of the exemption levels;
- transfer radioactive material exceeding the exemption levels, for which the corresponding contract will be subscribed to ENRESA;
- make whatever arrangements are in their power to return to overseas suppliers whatever radioactive material might be detected in their supplies; and
- collaborate in training and information plans.

The protocol establishes the course of action to be implemented whenever radioactive material is detected in scrap or in the products resulting from its processing, which consists basically of the following:

- subjecting all metallic materials and products resulting from their processing and entering steelyards and scrap processing facilities to radiological surveillance.
- immobilising shipments and interrupting processes in which radiation has been detected in excess of the investigation levels;
- performing detailed inspections of shipments or process lines in which radiation has been detected in excess of the investigation levels;
- carrying out the inspections using personnel with suitable knowledge of instrumentation and radiological protection, and a UTPR shall be called in if the radioactivity is detected in process materials;
- including the results of the inspection in a report that explicitly indicates whether the radioactive material exceeds the exemption levels;
- isolating radioactive materials exceeding the exemption levels, under safe conditions, pending removal by ENRESA.;
- notifying the CSN, attaching the report by the specialist;
- the CSN notifying both the facility and ENRESA of the applicability of the generic Authorisation for transfer, and shall register the event;
- ENRESA removing radioactive wastes exceeding the exemption levels, in the terms foreseen in the contract established with the subscribing company, and shall keep such wastes in custody pending their return, transfer to an authorised user or management as radioactive wastes; and
- in the event of the dispersion of radioactive material, the MINER establishing the actions to be taken, with advice from the CSN.

The Protocol establishes that the actions will be financed by the subscribing companies, except as regards the costs arising from the detection of radioactive sources of national origin, which shall be financed through the ENRESA Fund, and that the subscribing companies may pass on such costs to third parties.

The implementation of the protocol is complemented by the development of the following documents:

- *Communication of Entry* on the Register of subscribing companies.
- The generic *Authorization for Transfer*<sup>5</sup>, which establishes the criteria to be used to define investigation and exemption levels and other additional precautions required to guarantee the safety of the system established and the transfer to ENRESA of radioactive materials.
- A *CSN Safety Guide*, including recommendations on the technical characteristics of the surveillance and control system, the training of specialist technicians, the capacities of the UTPR, etc.
- The *Type Contract* between ENRESA and the subscribing companies, establishing the conditions of a civil nature for the transfer of radioactive materials detected.
- The *Notification Forms* for cases of detection, included in the Protocol itself.
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## **INSTALLATION AND IMPROVEMENT OF DETECTION SYSTEMS**

### *INSTALLATION OF SPECIFIC DETECTION SYSTEMS*

From the instrumental point of view, the implementation of the protocol refers specifically to the installation of radiation detection systems at metal smelting facilities and those recovery centres at which the scrap is processed (compaction, fragmentation, shearing, etc).

The surveillance and control systems of the subscribing companies may include different types of detection instruments, depending on the dimension and characteristics of the process carried out:

- automatic gate monitors, located at the entrances and exits of plants, for the detection of radiation in shipments of metallic materials;
- portable detection systems for the detailed inspection of shipments in which radiation has been detected or for use at smaller recovery facilities; and
- systems for  $\gamma$  spectrometry analysis of samples taken from the process, in order to guarantee that the resulting products are free from radioactive materials.

In addition, certain facilities may install beacon-type radiation detection equipment in areas of special interest.

### **IMPROVEMENT OF ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE**

The CSN has an environmental radiological surveillance network made up of automatic stations and a network of university laboratories, the objective of which is to maintain a permanent watch over environmental radiological quality.

The lowest levels of radiation that the network stations and laboratories are capable of detecting are sufficient to guarantee the health of persons but not to detect events such as the one that occurred at ACERINOX.

The CSN network is being complemented with a new system which is less dense but equipped with high sensitivity apparatus designed to detect extremely low concentrations of

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<sup>5</sup> Resolution of the Directorate General for Energy, of February 2000, authorising the transfer to ENRESA of radioactive material detected during the radiological surveillance of metallic materials and their processing.



radioactivity in the air. The detection thresholds are close to the levels of contamination that would be expected as a result of events having the characteristics of the ACERINOX incident.

## **TRAINING AND INFORMATION PROGRAMMES**

A training programme on radiological protection and instrumentation has been set up for the management and technical staff of steelyards and scrap storage facilities, along with an information programme for the rest of the personnel. These consist of:

- a *general level* on the fundamentals of radiological protection and the risks deriving from the presence of radioactive material in scrap, aimed at the management and technical staff of steelyards and scrap storage facilities.
- a *technical level* on instrumental techniques and initial actions, aimed at technicians who are required to intervene whenever radioactive material is detected in scrap shipments.
- an *information level* aimed at all the personnel working in the metal smelting and recovery industries, to promote the prevention of risks arising as a result of the presence of radioactive material in scrap.

## **ENHANCEMENT OF EMERGENCY PLANS**

The Basic Nuclear Emergency Plan (PLABEN) is oriented towards emergencies occurring at major nuclear installations, and does not specifically contemplate radiological emergencies at other facilities.

With a view to covering the latter, the CSN and the Ministry of the Interior are reviewing the PLABEN, the aim being to cover a wider spectrum of emergency situations, such as the one that occurred at ACERINOX.

## **CONCLUSION**

The MINER, the Ministry of Public Works, the CSN, ENRESA and the business associations of the metal smelting and recovery industries have established a national radiological surveillance and control system aimed at preventing the risks arising from the presence of radioactive material in scrap and in the products resulting from its processing.

This surveillance and control system:

- is based on a specific legal framework;
- consists of a protocol for collaboration between the companies recycling metals and the Administration, in which the parties undertake to voluntarily establish a set of technical, administrative and safety measures aimed at detecting, segregating, characterizing and managing, without risk, whatever radioactive material might potentially be contained in scrap or in the products resulting from its processing; and
- is complemented by a radiological training and information programme oriented towards the managers, technicians and workers of companies involved in the metal recovery and smelting industries, by improvements to the national environmental radiological surveillance systems and by the enhancement of the radiological emergency plans, in order to take into account events occurring outside the installations subject to the nuclear legislation.